THE EFFECT OF MOVIDA ON RESIDENTIAL PROPERTY PRICES: AN EXAMPLE FROM TURIN

Residential prices: up or down

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ABSTRACT

Hedonic regression technique has often been used to study the effect of road, railway and airport noise on property prices. However European cities are experiencing a particular type of noise pollution originated by nighttime recreational activities mainly located in the city centers, the so called "Movida", which hasn't been properly investigated yet. The aim of the paper is to examine the effect of recreational noise on residential property prices. We used an original highly detailed housing transactions dataset from the City of Turin covering the period 2017 to 2018 and built an indicator of recreational noise based on the proximity of dwellings to the night recreational activities. The results obtained employing hedonic modelling show that the adverse environment for an apartment located in a "Movida" district will result in a lower market value as compared to an apartment with similar characteristics, except for recreational noise. This occurs because potential buyers reduce their demand, as they discount present value of the costs of annoyance, loss of tranquility and health effects due to sleep deprivation.

1. INTRODUCTION

According to the World Health Organization (WHO-JRC, 2011): "One in three individuals is annoyed during the daytime and one in five has disturbed sleep at night because of traffic noise. Epidemiological evidence indicates that those chronically exposed to high levels of environmental noise have an increased risk of cardiovascular diseases such as myocardial infarction. Thus, noise pollution is considered not only an environmental nuisance but also a threat to public health."

The most common sources of noise pollution, and consequently those which have been mainly investigated, are related to traffic and industrial activities. However, in the last three decades European cities have been affected by a particular type of noise pollution caused by night-time recreational activities generally located in the city centers, the so-called "Movida", initially considered by the local authorities as a means of revitalizing urban central districts.

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Night-time economy is a complex phenomenon which carries high potentials in terms of social and economic benefits, but also problems related to the impact of alcohol on crime and disorders, coupled with public nuisance caused by recreational noise pollution. See Bevan (2011), Hadfield (2017) and Ottoz et al. (2018).

In spite of its relevance and diffusion, the implications, both social and economic, have been poorly investigated so far: recreational noise is not even mentioned in the EEA Report, Noise in Europe 2014, where environmental noise is defined as unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic and from sites of industrial activity".

Hedonic pricing modelling is employed to examine the disamenities of an urban or a suburban location based on the price structures of adjacent residential properties following the development of geographical information systems and the improved quality and availability of real estate geo-coded data.

Hedonic regression techniques have often been used in the literature to study the effect of road, railway and airport noise on real estate property prices, but little evidence exists on the role played by recreational night time noise.

The goal of the paper is to investigate the effects of recreational noise on house prices, providing an original proxy based on the proximity of houses to the night recreational activities, obtained by scraping Google Maps data. Commercial activities such as pubs, discos, restaurants are likely to be associated to night nuisance due to late night opening of such premises, 2 and even 3 a.m., coupled with crowds in the streets and loud music.

Two conflicting views are present on the issue: according to the first one, the impact of recreational noise on the quality of life determines a decrease in the residents' well-being, mainly related to sleep deprivation, whereas the second view stresses the gentrification positive effect of "Movida" on urban areas.

In one case the adverse environment for an apartment located in a "Movida" district will result in a lower market value as compared to an apartment with similar characteristics, except for recreational noise, because potential buyers reduce their demand, as they discount the present value of the costs of annoyance, loss of tranquility and health effects. Along this line are the results obtained by Patrigest (2011), an Italian company specialized in Valuation and Advisory for real estate, in a research reaching the conclusion that excessive noise, in particular because of nearby pubs and discos, depreciates the real estate's value by 10 to 20%.

According to the supporters of the second approach the price per square meter of properties will increase after "Movida" development, at least in certain districts, which were previously dilapidated and where nighttime economy could be viewed as a means to restart an area and to make it trendy.

The two statements are not necessarily contradictory because in the districts affected by the phenomenon we face a fragmented situation where two neighbors may report very distant night experiences, according, for instance, to the location of bedrooms.

We used an original highly detailed housing transactions dataset referring to the City of Turin covering the period 2017 to 2018 and built and indicator of recreational noise based on the proximity of residential properties contained in the data set to the recreational activities operating at night.

The choice of Turin as reference city is justified along several lines. The city represents the fifth Italian residential market and its market trend well represents the national one. In the last 20 years, Turin has overcome major urbanistic and social transformations, mainly due to the progressive decline as an industrial city in the Italian and European context. Since 2006 Winter Olympic Games, local authorities have promoted the city as a touristic location, with the connected phenomenon of gentrification and leisure attractiveness. As a consequence, central districts became increasingly interested by recreational noise.

Next section briefly reviews the empirical literature on hedonic pricing and noise. Section 3 describes the dataset. Section 4 presents the main estimation results stemming from hedonic modelling, providing a measure of depreciation due to recreational noise. Section 5 concludes.

2. LITERATURE REVIEW

Reports of the European Commission confirm that noise pollution in the environment is a very serious threat to public health and that noise exposure in Europe is increasing (European Union, 2002; European Commission, 2003). It is estimated that the main threat to the acoustic climate is traffic noise, both in the cities and outside them, but other noise sources, such as train and airport noise pollution, have been considered. Although our perspective does not completely coincide with the research on the impact of noise pollution on property values which generally refers to traffic noise, we briefly review relevant contributions.

Navrud (2002) summarized the results of 65 noise evaluation studies, generally related to vehicular traffic, mainly based on noise depreciation sensitivity index (NDSI), originally developed by Walters (1975). The results for the case of vehicular noise suggest that for each dB of noise increase the property price decreases by 0.64 per cent, with an interquartile range (50 per cent of cases) of 0.26-0.89 per cent; in general, 90 per cent of these studies reported a NDSI lower than 1.23 per cent.

Zietz (2005) examined the impact of noise pollution on property values focused on proximity to an airport. The results did not find any meaningful correlation between airport noise and the selling price of a house. Rahmatian and Cockerill (2011), using a large and detailed dataset found that properties located within 5,000 meters from a large airport have an average price that is estimated to be 4% to 10% lower than homes located outside that range.

Brandt and Maennig (2011) examined the influence of road noise on the prices of condominiums in Hamburg, Germany: on the basis of micro-level datasets capturing traffic-noise exposure, price discounts have been estimated in the amount of 0.23% following a 1 dB(A) increase in road noise.

Cellmer (2011) investigated by spatial analysis the impact of noise on the average prices of residential real estate in the city of Olsztyn, Poland. The results indicate that road traffic noise significantly impacts the usable value and, consequently, the prices of real estate. In a recent paper Beimer and Maennar (2017) simultaneously analyzed the effects of alternative noise sources: flight noise bears the most negative effect on housing prices, whereas road and train noises had similar but smaller effects.

Many studies apply hedonic pricing models to investigate the impact of environmental and other characteristics on property transaction prices.

Marmolejo et al. (2009) purpose was to determine whether noise had a stationary impact on property prices. The analysis suggests that the noise level does matter, although the noise depreciation sensitivity index (NDSI) found (0.08 per cent) is in the bottom decile of the HP studies reviewed by Navrud. The NDSI is not stationary throughout the city, suggesting that 1 dB has a different impact in different areas. Noise impact seems to depend not only on the noise intensity to which dwellings are exposed but also on the nature of the noise sources.

Chang and Kim (2013) offered a valuation of urban rail noise in South Korea. The model adopted provides a reasonable explanation of the determinants of property values, with a unit increase in dB(A) decreasing property value by 0.53% in the Seoul area.

Trojanek et al (2017) analyzed the impact of aircraft noise on housing prices. in the years 2010 to 2015 in Poznan. They found strong evidence that aircraft noise is negatively linked with housing prices, in line with previous studies in other parts of the world..

Batog and others (2019) investigate the influence of airport operation on property prices. They applied spatial hedonic regression and a difference-in-differences approach to address the introduction of new land use restrictions on property prices.

Del Giudice and others (2019) propose two studies using a semi-parametric additive model (Penalized Spline Semiparametric Method) that investigates the effects of traffic road noise on property prices in Naples. The estimated percentage depreciation was progressively increasing with the noise level. In the case study, the authors show that real estate values are reduced by about 0.30% for every noise pollution unit (dB) if considering only diurnal noise emissions, and the same values are reduced by about 0.33% for every pollution unit (dB) if considering only nocturnal noise emissions.

3. DATA

The empirical analysis in the paper is based on two main datasets.

The first dataset was obtained from the Italian Real Estate Market Observatory, in italian Osservatorio del Mercato Immobiliare (OMI), the Italian Revenue Agency (Agenzia delle Entrate) and the Italian Association of Realtors (AICI), which provide microdata from each transaction. It covers about 60% of all housing transactions[2] in the city of Turin from 2017–2018 (Figure 1): for 6918 observations we know the transaction price, as well as some housing characteristics, such as the construction year, the size in square meters, the number of baths, the building characteristics (lift, restoration, floor), and some environmental variables that indicate the presence of a garden, transport stops, train station, garage, and commercial services nearby the properties, the cadastral classification, and a calculated index, the walkability score, which represents the nearby presence of desired destinations.

The second one has been extracted by scraping the Google Maps Application Programming Interface (API) Places[3], which returns information on the global points of interests. It contains the exact geo-referenced localization of the recreational activities in the central districts[4] of the City of Turin and other related information, including the opening days and the closing hours for a large part of commercial activities.. Starting from the geo-referenced real estate data, information was collected about nearby bars, nightclubs, and cafes, which are the main drivers of "Movida" noise. Overall, 1074 commercial activities were checked, which are localized within 100 meters from real estates in the central districts (see footnote 4). Opening days and closing hours were available for 65% records, allowing to select activities that are open during night hours from 10 p.m. to at least 2 a.m., in "Movida" days[5]. This represents a proxy of nighttime disturbance caused by loud music and people chatting outside pubs, bars, and nightclubs.

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[2] All variables are specified in real terms. House prices are eflated by the national urban Consumer Price Index managed by Istat.

[3] Scraping was done using RStudio 1.1.463 (RStudio Team, 2015) and the googleway (v2.7.1; Cooley and Barcelos, 2018) package. The full reproducible code is available under request.

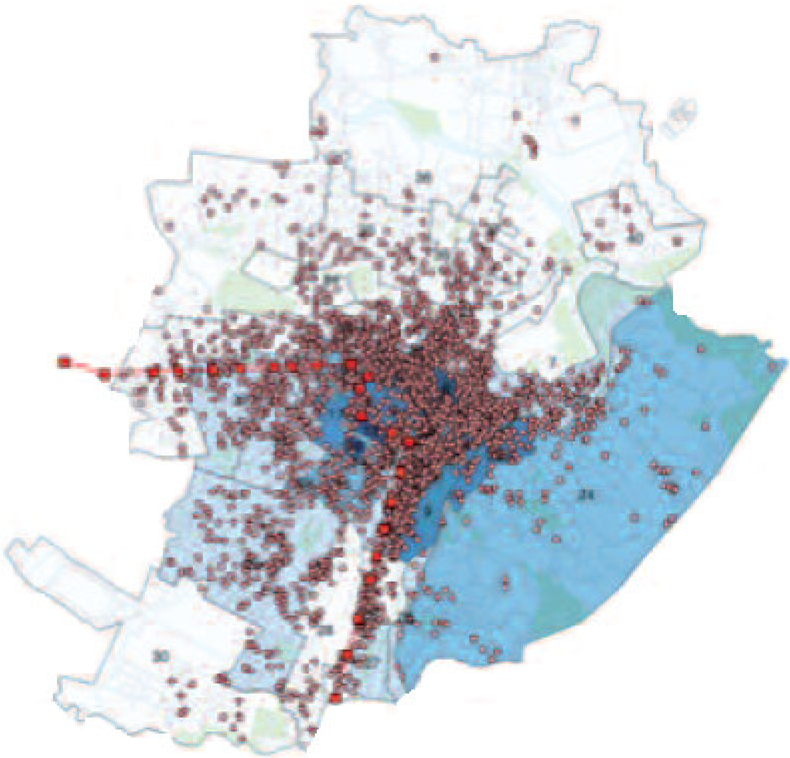
[4] The corresponding areas and codes as defined by the Osservatorio del Mercato Immobiliare are: B1—B7 Centro and Quadrilatero (Roma, Carlo Emanuele II, Solferino, Vinzaglio, Garibaldi, Castello, Rocca), B8 San Salvario, C16 Vanchiglia, Corso Belgio, Lungo Po Antonelli, C11 Michelotti, C12 Crimea, E1 Collinare Villa della Regina, D15 Barca Bertolla, D14 Cimitero Monumentale Botticelli,.

[5] In particular Saturday night after 10 pm was chosen as reference period.

In order to better understand the characteristics of the accommodations sold on the Turin market in the above-mentioned time span, geo-referenced data were then analyzed considering first of all the types of accommodation on offer, physical characteristics and dimensions of the units. The regressions were run on two distinct samples: the full sample (A) counting 6,918 apartments located in different parts of the city and a central subsample (B) counting 1,796 observations in the central districts (see footnote 4), which are mostly interested by "Movida" activities.

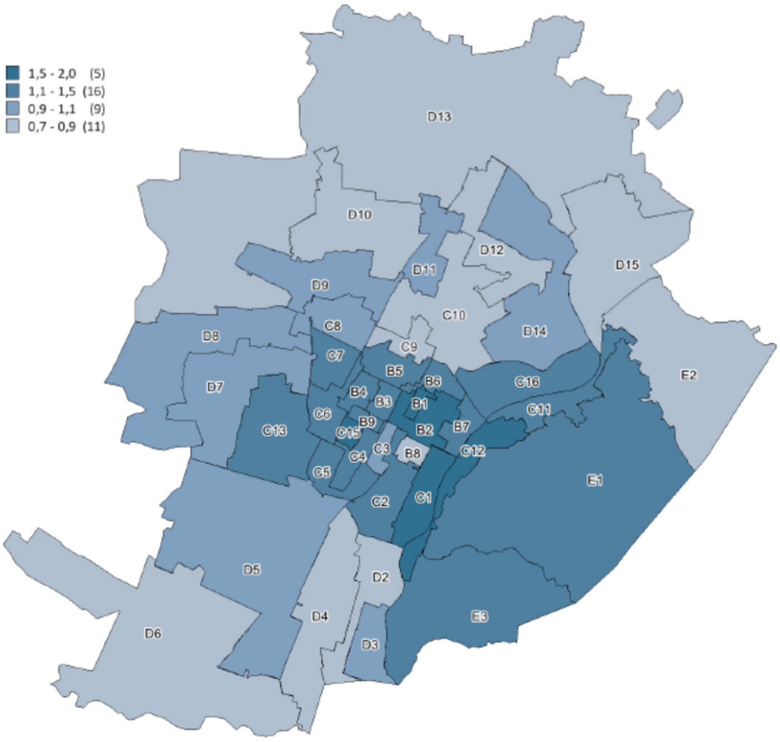
Figure 1a shows the dwellings sold in years 2017-18 in Turin and figure 1b the average price dispersion. Figure 2 shows the distribution of price per square meter (€/sqm) in the sample (A) and in the central subsample (B).

Figure 1a – Dwelling sold [SL1]in years 2017-2018 in Turin



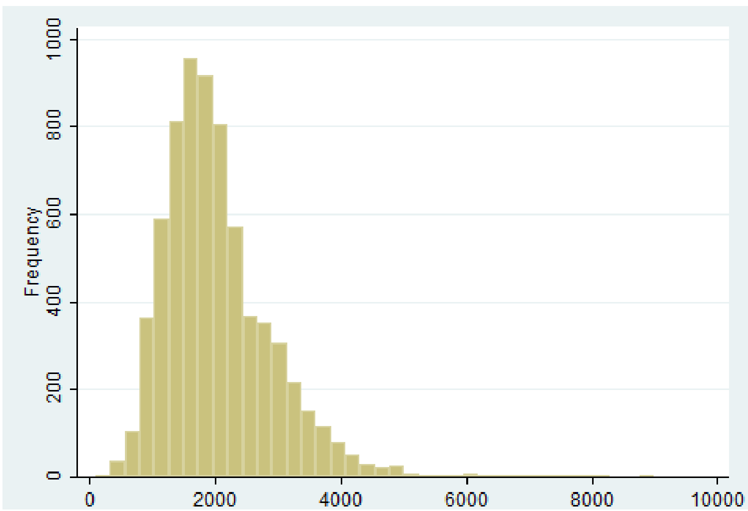
Source: our elaborations

Figure 1b – Average price dispersion in the real estate market 2017-18 in Turin



Source: *Osservatorio del Mercato Immobiliare (2019)*

Figure 2 – Distribution of price per square meter (€/sqm) in the sample (A) and in the central subsample (B)



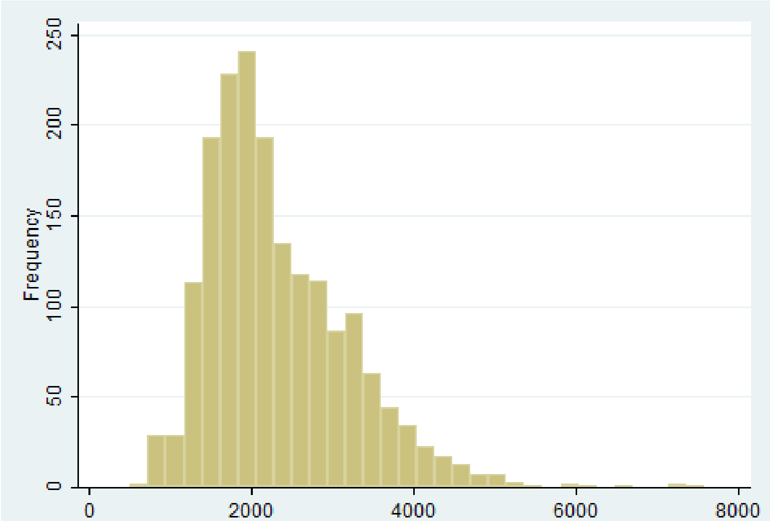


Table 1 compares the size of apartments sold in the whole city during 2018 (PWC, 2018), in the OMI sample, and in the central subsample. In particular, both the sample and subsample over-represent small size apartments with respect to all transactions recorded in the city. However, Table 2 shows that the average size of apartments by cadastral typology is highly in accordance with the average size of the total stock of apartments in the city (Agenzia delle Entrate, 2018). In particular, on average well-finished dwelling-houses (type A02) are sized about 110 sqm, economic dwelling-houses (type A03) about sqm 80, and cheap dwelling-houses (type A04) about 65. Since the fraction of A02 apartments represents the 69,1% of the sample and the 74,8% of the central subsample, our data allow us to concentrate with confidence on an average size of about 110 sqm.

Table 1. Standardized number of transactions (%) by dimensional classes in our sample, central subsample and in the whole city of Turin.

	Up to 50 sqm	**Between 50 and 85 sqm**	**Between 86 and 115 sqm**	**Beetween 116 and 145 sqm**	**146 sqm and above**
Population	12.9	46.6	23.7	9.2	7.7
Sample	8.9	36.8	29.0	12.2	13.1
Central Subsample	8.2	32.3	30.2	14.5	14.8

Data source: *Real Estate Market Overview (Pwc, 2018) and our elaborations*

Table 2. Average size of apartments (sqm) by cadastral typology in the stock of apartments in Turin, in the OMI sample of apartments sold and in the central subsample.

	A02	**A03**	**A04**
Stock of apartments, whole city	118	83	67
Sample	108	77	63
Central Subsample	111	80	61

Cadastral Typologies: A02 Well-finished dwelling-houses; A03 Economic dwelling-houses; A04 Cheap dwelling-houses

Data source: *Agenzia delle Entrate (2018) and our elaborations*

The variables available in the dataset and included in the regression are:

- *Physical building characteristics*: according to the body of literature on transaction we consider the effects of age, size in squared meters (sqm), floor, number of bathrooms, lift, car park (Sirmans, Sirmans and Benjamin, 1989; Clapp, 1993; Dunse *et al.*, 2003). To control for bias due to renovation, age is defined as the difference between the date on which the residential property was sold and the date of its eventual renovation; moreover, we distinguish historical buildings and those enjoying a view of the river and/or mountains.
- *Walkability*: the presence of desired destinations within walking distance of a property may be important (Handy, 1993; Hoehenr *et al.*, 2005). The walkability score, according to Li and Brown (1980), rates the walkability of an address by determining the distance[6] to relevant points of interest (POIs) as schools, retail, recreational, entertainment, and food destinations using the Geo-Poi web-based tool of the Italian Revenue Agency[7].
- *Accessibility*: a set of dummy variables, reflecting the points of interest easily reached by all transport modes within half kilometer: transport stop, reflecting the presence

[6] If distance to the closest POI of a certain type is less than one-quarter kilometre, Walk Score assigns the maximum number of points for that type. Finally, each type is weighted equally and walkability is normalized to a score from 0 to 100 (Pivo and Fisher, 2011).

[7] https://wwwt.agenziaentrate.gov.it/geopoi_omi/index.php

of a bus/metro stop; services, i.e. community facilities; schools; the presence of green areas; commercial activities. We also test the distance to the city center and to the train station in meters, measured by a distance calculated by the coordinates detected on GeoPoi and the city center (CG), and distinguish properties located in the suburbs.

Tables 3 and 4 respectively report the descriptive statistics of the whole sample and of the central subsample of transactions. The average size of dwellings in whole the sample is around 100 sqm, and slightly larger in the central area (104 sqm). Accordingly, the average price is slightly higher in the central districts (about €256,000 vs €214,000), but the variance is large. Figure 2 shows the distribution of prices per square meter in the sample and subsample.

Most of the dwellings included in our sample (61.5%) were built before 1971, and more than half (34.9%) were totally renovated in the previous 20 years. Similar data are observed in the central districts (65.5% buildings built before 1971 and 36.3% renovated buildings).

The characteristics of properties do not change considerably in time. About 10% are located in historical buildings and the average floor level is the 3rd (the 2rd in the subsample). About 16-17% have a view of the river Po or the mountains.

The accessibility variables, constructed using the GIS data, show that the 85% of the dwellings are located within one kilometer from the city center, half of them enjoy a green area and the presence of services within half kilometer, about all of them are served by public transports. This illustrates that the City of Turin is dense; it has about 886,837 inhabitants on 130 km^2 with spatially concentrated infrastructure.

Table 3. Descriptive statistics (n = 6,918).

Number of observations: 6918				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
Price	214,308	187,726	10,000	3,003,000
Price sqm	2,045	867.91	500	9,000
Services (500m)	0.508	0.499	0	1
Historical building	0.097	0.296	0	1
Distance to city centre (1km)	0.853	0.353	0	1

Green (500m)	0.537	0.498	0	1
Transport stop (500m)	0.990	0.098	0	1
Distance to train station (500m)	0.941	0.235	0	1
Car park	0.051	0.220	0	1
*Age**	41.861	22.883	6	219
View of river or mountains	0.161	0.367	0	1
Commercial	0.991	0.093	0	1
Floor level	3.043	1.903	1	9
Walk score	0.406	0.274	0	1
Number of baths	1.231	0.501	1	5
Total surface	99.133	49.000	20	650
*Offer sheet** (12 months)*	0.734	0.441	0	1

* Age is defined as the difference between the date on which the residential property was sold and the date of its eventual renovation
** This dummy indicates whether the dwelling has been on offer in the last year

Table 4. Descriptive statistics (n = 1,796).

Number of observations: 1796				
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
Price	255,967.1	220,181.7	10,000	3,000,000
Price sqm	2,320.14	882.4023	500	7,571
Services (500m)	0.617	0.486	0	1
Historical building	0.104	0.306	0	1
Distance to city centre (1km)	0.830	0.376	0	1
Green (500m)	0.538	0.499	0	1
Transport stop (500m)	0.992	0.091	0	1
Distance to train station (500m)	0.919	0.273	0	1
Car park	0.058	0.234	0	1
*Age**	40.812	24.845	6	219
View of river or mountains	0.765	0.424	0	1
Commercial	0.174	0.379	0	1
Floor level	2.370	1.977	0	9
Walk score	0.499	0.370	0	1
Number of baths	1.722	1.347	1	9
Total surface	104.009	53.595	20	650
*Offer sheet (12 months)***	0.723	0.447	0	1
““Movida”” in 50 m	0.450	0.984	0	6
““Movida”” in 51-75 m	0.450	0.948	0	7
““Movida”” in 76-100 m	0.693	1.287	0	9

* Age is defined as the difference between the date on which the residential property was sold and the date of its eventual renovation
** This dummy indicates whether the dwelling has been on offer in the last year

As the real estate dataset covers an exhaustive record of geocoded residential building data, it was possible to calculate the line distance from each property to the nearest recreational activities, matching information from the Google Places API dataset. This exercise has been carried out just for the central districts described in footnote 4.

The last part of Table 4 reports recreational noise proxies based on the proximity of dwellings to “Movida” commercial activities. About half of apartments of the central subsample has bars, nightclubs or pubs, the main drivers of recreational noise, within 100 meters, about 36% within 75 meters and 25% within 50 meters. However, the corresponding average number of nearby pubs/bars/nightclubs is 1.6 within 100 meters, 0.9 within 75 meters and 0.45 within 50 meters. The maximum number of “Movida” activities observed within 50 meters amounts to 6, while the maximum within 100 meters is 16.

4. EMPIRICAL RESULTS

The hedonic function[8] we estimate is the following

$$\ln P_i = \alpha + \sum_{k=1}^{K} \beta_k z_{ki} + \varphi noise_i + u_i \qquad (1)$$

where lnP_i is the logarithm of the price per square meter of dwelling i; β_k is the implicit price of the k-th characteristic, z_k is a vector of characteristics; $noise_i$ is the recreational noise proxy with implicit price φ; u_i is the random error term. Note that the social valuation of house characteristics does not change over time.

We use semi-log specification (denominated log-lin), which is the most widely used functional specification because it helps to normalize the price and residual distribution, allowing the results from different studies to be compared. Then, the coefficients of the estimated hedonic equation can be interpreted as semi-elasticities, all the other characteristic the same. Hence, the percentage price variation due to recreational annoyance can be derived by the formula

$$\frac{\Delta P}{P} = \exp(\varphi) - 1 \qquad (2)$$

[8] According to Knight et al. (1995), the hedonic method controls for quality by using multiple regressions. The problems concern: the vector of characteristics, the instability of coefficients from one cross section to another, the specification of the hedonic functional form.

This specification was applied only to the subsample, which contains the noise proxy extracted from the web.

Table 5. Regression results for the whole sample.

VARIABLES	(1) log-lin
Sevices	0.324***
	(0.007)
Historical building	0.642***
	(0.014)
Distance to city center (1km)	-0.047***
	(0.012)
Green (500m)	0.103***
	(0.007)
School in 500 m	0.048***
	(0.016)
Transport stop (500m)	0.104***
	(0.033)
Distance to train station (500m)	-0.075***
	(0.014)
Located in city center	-0.085***
	(0.007)
Car park	0.127***
	(0.015)
Commercial	0.341***
	(0.032)
View of river or mountains	0.165***
	(0.009)
Walk score	0.174***
	(0.017)
Number of baths	0.083***
	(0.008)
Offer sheet (12 months)	0.548***
	(0.010)
Age	0.000
	(0.000)
Total surface	-0.000*
	(0.000)
Floor level	0.004***
	(0.002)
Constant	6.302***
	(0.046)
Observations	6,916
R-squared	0.655

*** p<0.01, ** p<0.05, * p<0.1

Standard errors in parenthesis

Table 5 reports the estimated results from the semi-log specification for the whole sample. According to standard criteria regarding the goodness-of-fit, our model explains a large share of the variance (R^2=0.65) and coefficients have the expected sign according to the majority of studies surveyed in Sirmans, Macpherson and Zietz (2005). The estimated coefficients are stable across the models and the F-statistic rejects the null hypothesis that all parameters are jointly equal to zero at the 1% level. The analysis of simple correlation matrices indicates that there are no significant dependencies between the variables, and the variance inflation factor (VIF) test confirms that there is no multicollinearity. Finally, the Breusch–Pagan test cannot reject the null hypothesis of constant variance.

Concerning the building characteristics, the coefficients for the variables historical building, view of river/mountains, number of bathrooms, floor level, and car park were positively estimated. This implies that dwellings with more facilities, i.e. more bathrooms and parking spaces, have higher unity prices. The age of the building, which was corrected for renovation, has no significant effect on prices.

Concerning accessibility, the proximity to public transportation, school, services, commercial activities, and green areas were positively estimated, as well as the walk score. Accordingly, the distance to the city center and to the train station have a negative effect on price.

4.1 HOW DOES RECREATIONAL NOISE AFFECT HOUSING PRICES?

For the central districts concerning the subsample the semi-log specification has been calculated. Results are shown in Table 6. The coefficients are highly in accordance with previous results on the whole sample, unless those related to the proximity to public transportation and school, which are no longer significant.

Hedonic pricing models usually refer to the noise sensitivity depreciation index (NSDI), which is the percentage change in house prices per dB increase in noise level according the definition of European Union (2002). The European Commission recommends a traffic noise annoyance valuation of 23.5 euros per decibel per household per year (Navrud, 2002, 2004).

As a precise noise phonometric measurement for recreational noise is not available, we proxied nighttime annoyance by the number of open night commercial activities (pubs, nightclubs, and bars) within 100 meters. In particular, we analyzed the effect of noise annoyance within 50, 75, and 100 meters from the dwellings[9].

Our findings show that the indicator is significant in the range 51-75 meters, but it is not within 50 meters and from 76 onwards. The lack of effect within 50 meters could be due to measurement errors.

From the point of view of our analysis the geocoded address is certainly another source of error as well as the lack of information in our data set about orientation of the apartment. In fact, sites of interest can be located on georeferenced images. However, geo-referencing accuracy of Google images can be poor.

Secondly, the orientation of the apartment slightly affects its price but has a very strong effect on the perception of noise disturbance; an accommodation that overlooks the courtyard perhaps may be less affected from noise on the street. Furthermore, we do not know where the bedrooms are localized, whether towards the street or towards the courtyard. In addition, the coordinates calculated with the address are a source of error especially for very large buildings where the distance of an apartment from the street number can be even fifty meters.

In the semi-log model, the coefficient of -0.023 implies a price reduction of -2.7% for each night activity (see Table 8), which means that one additional commercial night activity between 51 and 75 meters bears a price reduction of 2.7%. As the mean price for squared meter in the sample is 2,320 euros, it implies a reduction of about 53 euros per square meter for each additional "Movida" activity. Hence, when the concentrations is high, as in the case of 4 commercial night activities, the effect on price is about -9%, i.e. a reduction of 211 euros per square meter. Considering an average dwelling size of 104 sqm, this implies a total price reduction of about 21,000 euros[10].

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[9] In fact, the regional environment Agency ARPA (Gallo *et al.*, 2018) measured night noise pollution just in very limited central areas in Turin from 10 pm to 6 am, finding very high decibel levels (between 72 and 76 dBA), which are much higher than the levels set by municipal regulation following official advice from the WHO World Health Organization, i.e. 55 dBA.

[10] The effect is possibly underestimated due to the negative price trends in Italy since the 2008 crisis.

Table 7 reports results for log-lin quantile regression model. It shows that in lower quantiles, meaning low price dwellings, the effect of “Movida” noise is not significant, while in higher quantiles it becomes significant and increasingly relevant. In particular, the presence of “Movida” activity within 51-75 meters from the dwelling implies a price reduction of -2.66% for squared meter in the 50^{th} quantile and -3.63% in the 75^{th} quantile.

Table 6. Regression results for the central subsample.

VARIABLES	(2) log-lin
Services	0.376***
	(0.016)
Historical building	0.673***
	(0.029)
Distance to city centre (1km)	0.006
	(0.023)
Green (500m)	0.072***
	(0.014)
School in 500 m	0.035
	(0.031)
Transport stop (500m)	-0.033
	(0.073)
Distance to train station (500m)	-0.071***
	(0.027)
Car park	0.142***
	(0.029)
Commercial	0.196***
	(0.019)
View of river or mountains	0.274***
	(0.025)
Walk score	0.289***
	(0.033)
Number of baths	0.006
	(0.006)
Offer sheet (12 months)	0.147***
	(0.017)
Age	0.000
	(0.000)
Total surface	-0.000
	(0.000)
Floor level	0.005
	(0.004)
“Movida” in 50 m	0.009
	(0.007)
“Movida” in 51-75 m	-0.023**
	(0.010)
“Movida” in 76-100 m	0.004
	(0.005)
Constant	6.905***

	(0.079)
Observations	1,796
R-squared	0.523

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parenthesis

Table 7. Effect of "Movida" (51-75 meters) on prices in the central subsample, different specifications.

Model specification	Sign	Coeff	ΔP/P (%)
Model (log-lin)	(-)	-0,023	-2,27%
Model (log-lin) - q50	(-)	-0,027	-2,66%
Model (log-lin) - q75	(-)	-0,037	-3,63%

5. CONCLUDING REMARKS

Hedonic regression technique has often been used to study the effect of road, railway and airport noise on real estate prices. However, European cities are experiencing a particular type of noise pollution originated by night-time recreational activities mainly located in the city centers, the so called "Movida", which hasn't been properly investigated yet. The aim of the paper is then to examine its effect on residential property prices.

We used an original highly detailed housing transactions dataset from the City of Turin covering the period 2017 to 2018 and built an original proxy of recreational noise based on the proximity of houses to the night recreational activities. The proxy is based on geo-referenced big data extracted from the web, in particular by scraping Google Places API. This strategy was due to the substantial lack of environmental measurement about recreational pollution.

The paper contributes to the literature, because we are among the first to study the effect of recreational noise on apartment prices within residential buildings using detailed geocoded micro data on observed residential prices.

The results obtained by hedonic modelling show that the adverse environment for an apartment located in a "Movida" district will result in a lower market value as compared to an apartment with similar characteristics, except for recreational noise. This occurs because potential buyers reduce their demand, as they discount present value of the costs of annoyance, loss of tranquility, and possible health effects.

Our findings show that our recreational noise proxy is significant in the range 51-75 meters. In the semi-log model, the coefficient of -0.023 implies a price reduction of -2.27%, meaning that one additional commercial night activity between 51 and 75 meters bears a price reduction of 2.27%. As the mean price for squared meter in the sample is 2,320 euros, it implies a reduction of about 53 euros for each extra pub nearby. Hence, when recreational noise is much concentrated, as in the case of 4 commercial night activities, the effect on price is about -9%, i.e. a reduction of 211 euros per square meter.

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